Air filter

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Abstract of **GB2043483**

The invention is concerned with a filter having an intake nozzle 12 which is connectable with a discharged air nozzle 14 of a pneumatic or electric tool having an extractor fan system. A filter cloth 22 can be fixed in the filter casing in any of a plurality of arrangements to divide the cavity in the casing into an intake section communicating with the intake nozzle and a discharge section communicating with outlets in the casing 16. The compact arrangement of the filter enables the latter to be connected directly with the tool to move therewith. Cleaning of the cloth 22 may be effected by depressing the knob 46 to shake the cloth 22. Another embodiment comprises a flat filter cloth and a rotatable brush for cleaning the cloth.

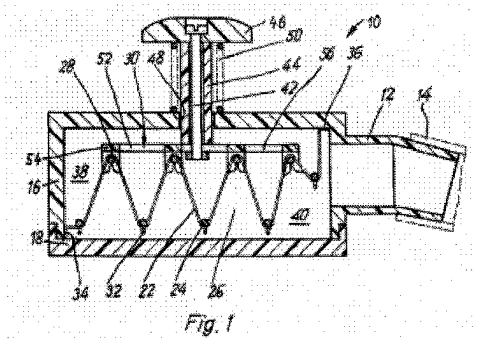

Fig. 1

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(54) Air filter

(57) The invention is concerned with a filter having an intake nozzle 12 which is connectable with a discharged air nozzle 14 of a pneumatic or electric tool having an extractor fan system. A filter cloth 22 can be fixed in the filter casing in any of a plurality of arrangements to divide the cavity in the casing into an intake section communicating with the intake nozzle and a discharge section communicating with outlets in the casing 16. The compact arrangement of the filter enables the latter to be connected directly with the tool to move therewith. Cleaning of the cloth 22 may be effected by depressing the knob 46 to shake the cloth 22. Another embodiment comprises a flat filter cloth and a rotatable brush for cleaning the cloth.

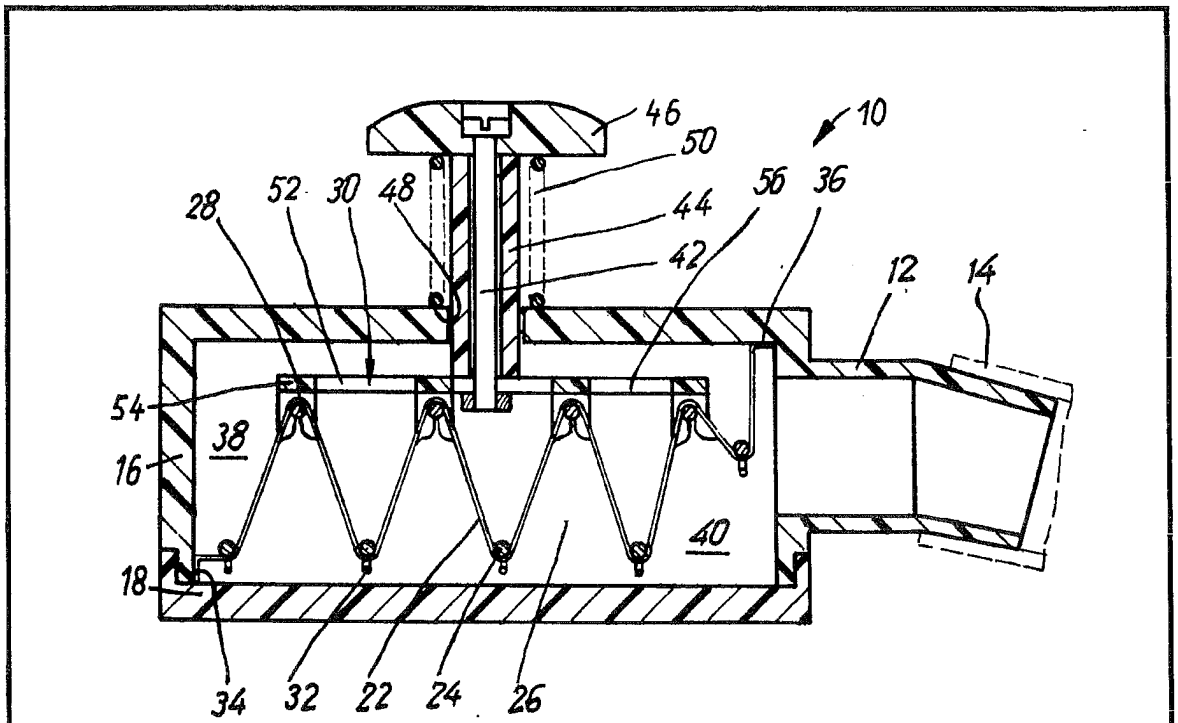

Fig. 1

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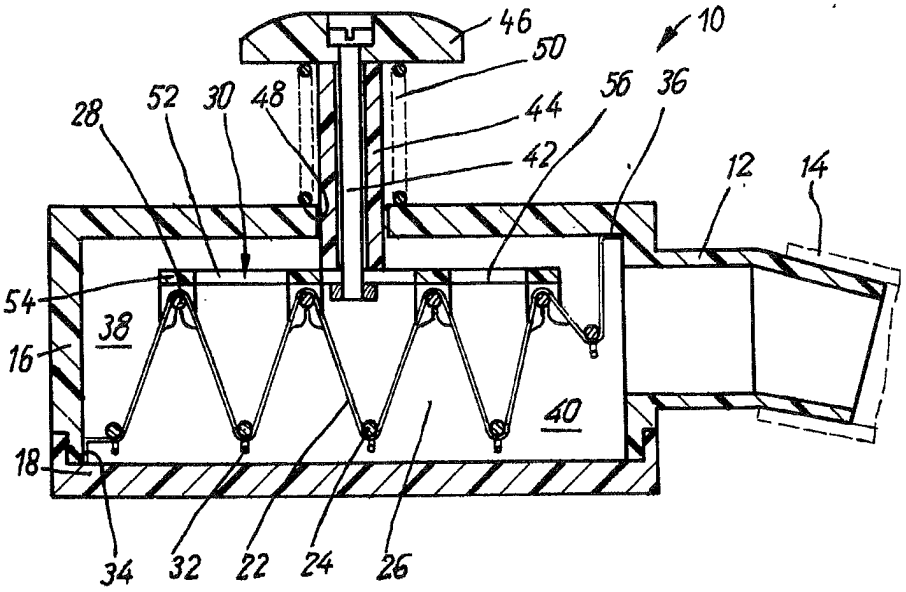
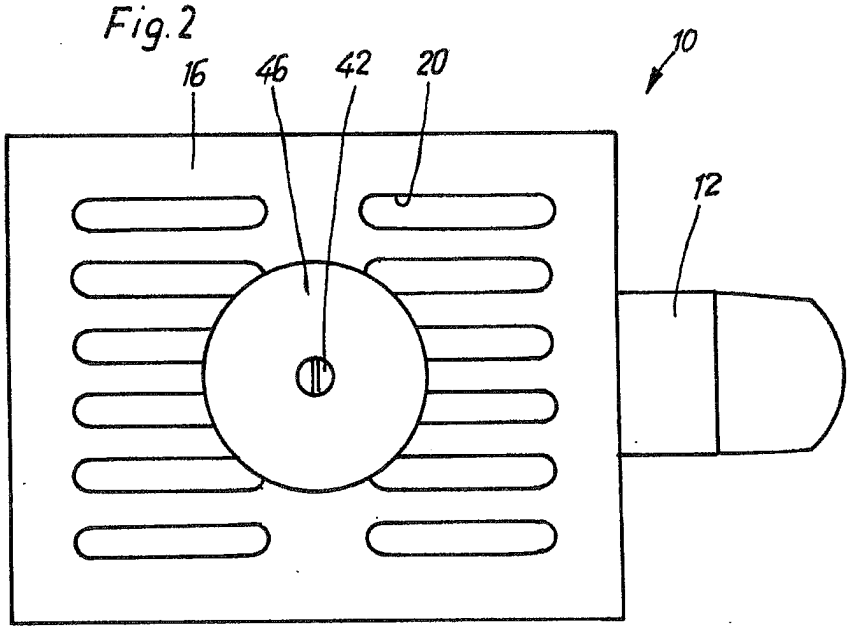


Fig. 1

Fig. 2



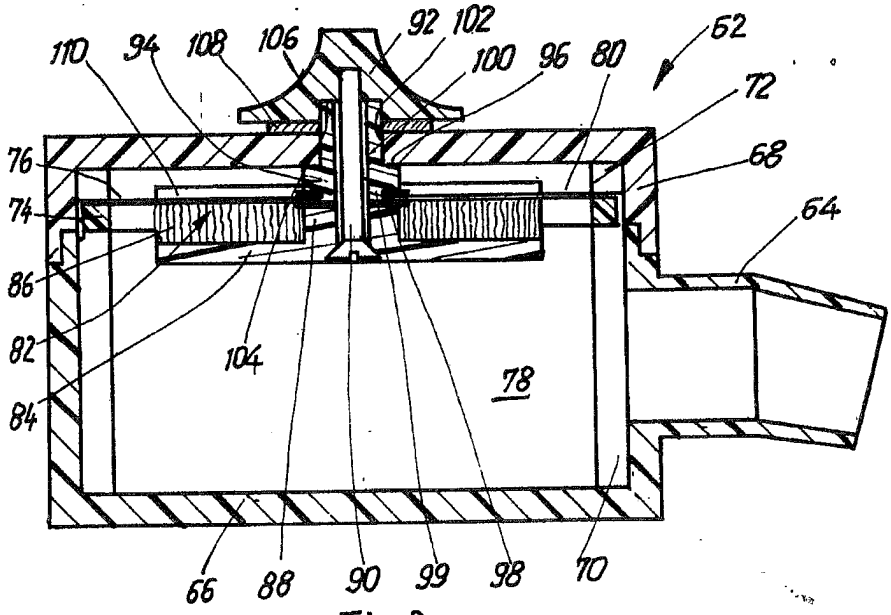


Fig. 3

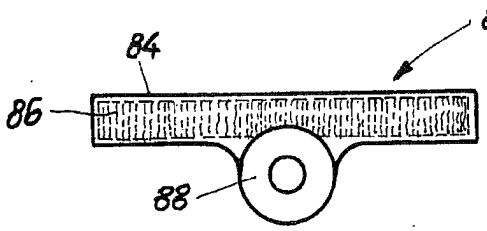


Fig. 4

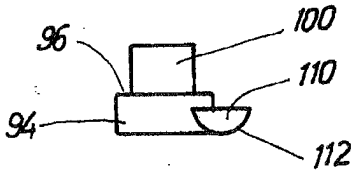


Fig. 6

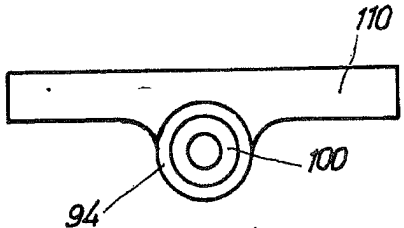


Fig. 5

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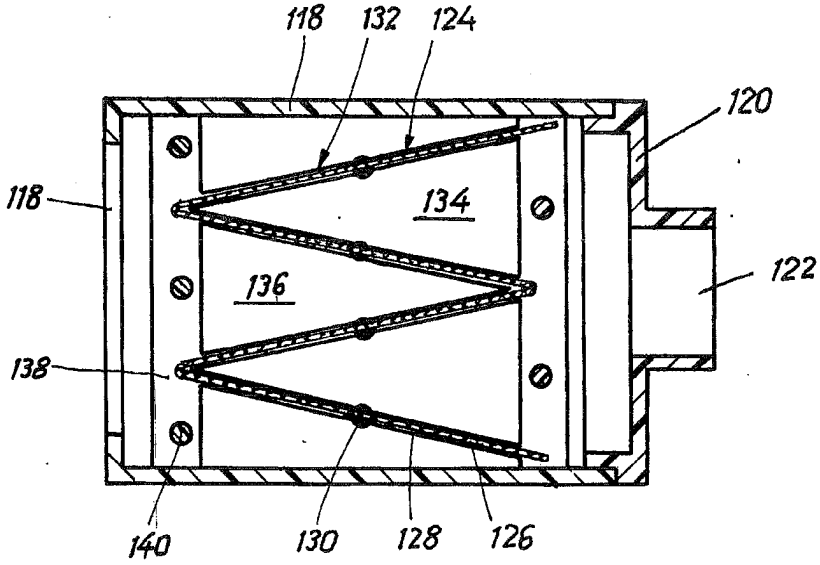

Fig. 7

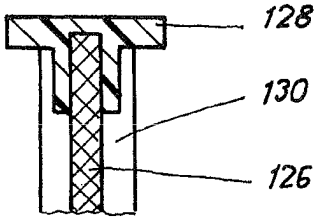

Fig. 8

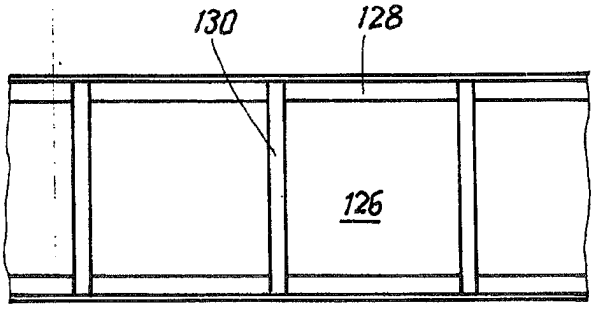

Fig. 9

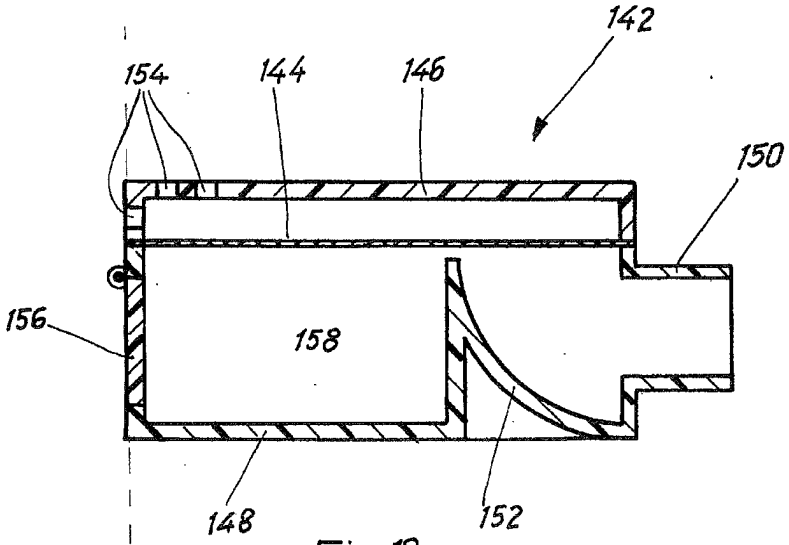

Fig. 10

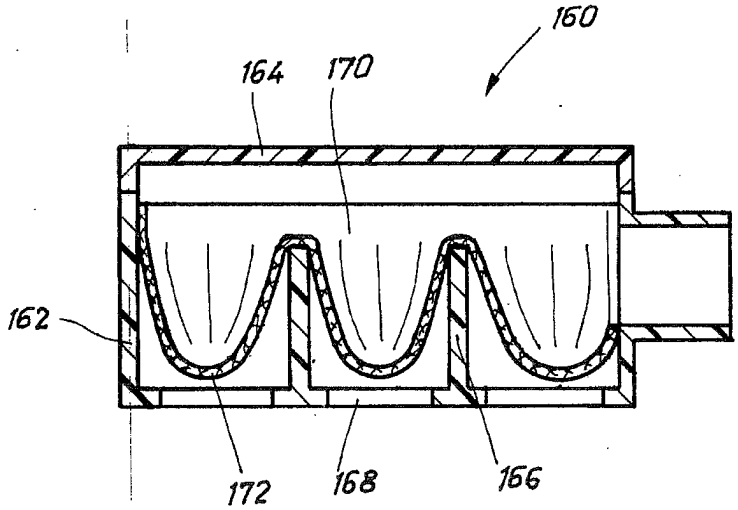

Fig. 11

SPECIFICATION

A filter for pneumatically or electrically operated tools

This invention relates to a filter for pneumatic and electric tools having a blower fan for waste air removal.

Large, stationary machines, where dust and chips are produced, for example wood-working machines such as circular saws, planing and grinding machines, are as a rule connected through hoses and shafts with a solids separator. With smaller pneumatically and electrically operated or manual tools such as keyhole saws, pendulum grinders, and the like, however, it is difficult to remove the chips and dust particles which collect at the tool when working with the components, because these tools are designed for full flexibility. For this reason dust and chips are often simply blown or drawn off the component surface and are distributed over the workshop atmosphere with the waste air which the dust uses as a means of transport. Obviously this is detrimental for the health of the personnel and for the appearance of the workshop.

It is an object of the present invention to provide a waste air filter system preferably for small hand operated, pneumatic or electric tools which does not interfere with flexibility of the tools.

According to the present invention there is provided a filter for pneumatic or electric tools having an extractor fan system, wherein the filter comprises a compact casing supporting an intake nozzle which is connectable with a discharged air nozzle on the pneumatic and electric tools.

Preferably, a filter cloth is fixed in a flat position and has edges glued on to the filter casing and the latter has a baffle section which is located behind the inlet nozzle and leading towards the filter cloth, and which is spaced by a predetermined distance from the filter cloth, an outlet for filtered air being provided at an end of the filter casing which is remote from the inlet nozzle.

Preferably also, a brush is movably located at an intake side of a filter cloth, a supporting body, which is coupled with the brush, being located at an outlet side of the filter cloth, the brush and supporting body being positioned opposite in alignment, or laterally displaced relative to each other so that by the relative positions of the brush and supporting body a shaped passage is defined for the filter cloth.

Further a filter cloth may be fixed inside the filter casing in zig-zag form, the cloth edge being glued on to the filter casing, and the cloth being supported in zig-zag form by ribs of the filter casing and extending between said ribs.

Alternatively a filter cloth may pass over two sets of supporting rods which are displaced relative to one another, one of the sets being movable whereby in one of the sets of supporting rods the distance from the axis of the inlet nozzle increases in proportion to an increasing axial distance from the inlet nozzle.

Also edges of a filter cloth may have spray moulded plastic webs, which extend in the longitudinal direction of the filter cloth and are interconnected through spray moulded plastic transverse elements, the filter cloth being glued into the filter casing with the aid of the plastics webs and being folded in a zig-zag arrangement with the aid of the plastic webs, the cloth at the points of the zig-zag being connected to spray moulded transverse elements of a plastics material.

Having very compact dimensions the filter according to the invention may be directly built on to the pneumatic or electric tool, to move together with the latter. The dimensions of the complete unit are not considerably greater than those of the machine alone. No expensive installations have to be carried out.

It was realised that the quantities of chipped material produced at the wood working machines could be removed with a relatively small dimensioned filter without having to interrupt the work by emptying the filter. This applies especially to grinding machines and keyhole saws which produce comparatively small quantities of dust even when working on large surfaces, but this fine dust is difficult to collect.

Embodiments of the present invention will now be described by way of example only, with reference to the accompanying drawings, in which:–

Figure 1 is a longitudinal section through a first embodiment of a filter for a small, manually supported, pneumatic or electric tool, for example a pendulum grinding machine;

Figure 2 shows the filter according to Fig. 1 in plan;

Figure 3 is a longitudinal section through a second embodiment of a filter developed for a manually supported small pneumatic or electric tool;

Figure 4 is a plan view of a cleaning brush for a filter cloth of the filter shown in Fig. 3;

Figure 5 shows a supporting body of the filter according to Fig. 3 in plan, which serves for the support of the filter cloth in the environment of the cleaning brush;

Figure 6 shows the supporting body according to Fig. 5 in elevation;

Figure 7 is a section through a third embodiment of a filter for a manually supported pneumatic or electric tool;

Figure 8 is a horizontal section through the edge zone of the filter element shown in Fig. 7, the filter element being shown on an enlarged scale;

Figure 9 is a plan view of a section taken of a continuous filter material which may be used for example for the manufacture of zig-

zag folded filter elements;

Figure 10 is a longitudinal section through a fourth embodiment of a filter developed for a manually supported pneumatic or electric tool; and

Figure 11 is a longitudinal section through a fifth embodiment of a filter for a manually supported pneumatic or electric tool.

Referring to Figs. 1 and 2 of the drawings, a filter 10 comprises a snaked and slightly conical inlet nozzle 12 suitable for connection with an outlet nozzle 14 (shown in broken lines) of a pendulum grinding machine or similar manually supported tool not shown in the drawing, operated pneumatically or electrically and therefore exposed to air with a content of minute particles of dust. The inlet nozzle 12 is an integral part of a casing main body 16 which is formed of an impact resistant plastics material. Its underside is closed by a cover 18 which is likewise injection moulded. Two sets of outlet slots 20 for the discharge of filtered air are provided in the upper side of the casing main body 16.

The internal part of the filter casing accommodates a filter cloth 22 laid in zig-zag form. For this purpose a first set of supporting rods 24 is fixed directly to side walls 26 of the casing main body 16. A second set of supporting rods 28 is carried by a holding plate 30.

Wire tie springs 32 of a length slightly exceeding, in their unloaded state, the transverse dimension of the filter cloth 22, rest at their ends in the seams at the sides of the filter cloth 22, which are not visible in the drawing. In this manner the filter cloth 22 is held tightly in the transverse direction and is in spring loaded contact with the side walls 26.

Of the supporting rods 24, the one at the far right hand side, as viewed in Fig. 1, is displaced towards the intake nozzle 12. With other embodiments of the filter, a greater number of supporting rods 24 may be displaced towards the centre of the filter casing so that the incoming air may be evenly distributed over the various parts of the filter cloth 22.

Two end sections 34 and 36 of the filter cloth are glued to the casing main body 16, so that the filter cloth 22 divides the cavity in the filter casing into a discharge section 38, which communicates with the outlet slots 20, and an intake section 40, which is connected with the intake nozzle 12, the width of the filter cloth 22 being equal to the distance between the side walls 26.

Dust particles which are collected during working on the filter cloth 22 are shaken off the cloth, the holding plate 30 being designed for vertical movement. A threaded bolt 42 tightens the holding plate 30, with the aid of a sleeve 44 which is manufactured of a low friction material, with a holding knob 46. Said sleeve 44 extends with a slight play through an opening 48 in the upper wall of the casing main body 16. A compression spring 50 which supports itself against the upper side of the casing main body 16 acts at the underside of the knob 46. The holding plate 30 is therefore pre-loaded in a position in which the filter cloth 22 is held taut in position.

The spray moulded holding plate 30 is of grille-like shape, comprising two longitudinal bars 52 and a plurality of cross-bars 54 which define the slot form of air passages 56. The cross-bars 54 have integrally formed holding elements 58, each having two arms and together defining a circular opening for holding one of the supporting rods 28. These openings open downwardly so that the supporting rods 28 may be pressed into the holding elements together with the filter cloth 22 under local deformation of the latter as indicated at 60.

In the event of the filter cloth 22 clogging up with dust drawn off the pendulum grinder, one simply strikes the knob 46 firmly with the palm of the hand, moving thereby the holding plate 30 rapidly downwards. Loaded by the compression spring 50, the plate returns into its position of rest shown in Fig. 1, where it is abruptly brought to a halt when the filter cloth 22 which is flexible but of little resilience is fully stretched. During these movements the dust clinging to the cloth is shaken off and drops on to the cover 18. It may be either removed from the filter casing by removing the cover 18, or the cover may be designed as a collecting trough for working dust which is taken out to empty the filter casing, after the cloth is shaken clean a number of times.

A filter 62 shown in Fig. 3 also has a snaked inlet nozzle 64 which is integrally formed on to a casing main body 66 where it serves as a catch trough for dust. The upper side of the casing body is closed by means of a cover 68.

There are prismatic projections 70 at the corners of the casing main body 66, projecting inwards so that they align with corresponding projections 72 of the cover 68. However, the projections 72 terminate short of a separating plane between the cover and the casing main body, leaving a gap between the adjacent front surfaces of the projections 70 and 72 for the playfree accommodation of a filter frame 74 of the corresponding depth.

A filter cloth 76 stretched fully flat is glued to the runners of the filter frame 74. Again, the filter cloth 76 divides the free space inside the filter casing as defined by the casing main body 66 and the cover 68, into an intake section 78 and a discharge section 80. The latter communicates through outlet slots in the cover 68, which are not visible in the drawing, with the environment. Since these slots are similar to the discharge slots 20 in Fig. 2, the filter, 62, in plan, is very similar to

the filter 10.

A rotary brush 82 consisting of a bristle holder 84 of a plastics material and bristles embedded therein, is provided to free the dust side of the filter cloth 76 from dust particles. The brush is completed by a bush 88 which is integrally formed on to the bristle holder 84, the latter being slightly displaced relative to the longitudinal axis of the bush 88 (see Fig. 4), the axial dimension of the bush being slightly smaller than the height of the bristles 86 when not loaded. A screw 90, projecting through the bush 88 connects the bristle holder 84 in a torsionally locked manner with a knob 92, whereby a spacer piece in the form of a bush 94, which has a shoulder 96 to support itself against the internal wall of the cover 68, holds the filter cloth 76 in position. On either side of the cloth, around the hole provided for the passage of the screw 90, is a hole-strengthening ring 98 made of a low friction material glued on to the cloth 76, the rings sliding along the adjacent end faces of the bushes 88 and 94. The two bushes 88 and 94 are locked with each other with the aid of an axial collar 99 which extends through the filter cloth 76 and the hole-strengthening rings 98 and the axial dimension of which slightly exceeds the thickness of the filter cloth connected with the hole-strengthening rings.

A reduced diameter section 100 of the bush 94 extends rotatably through an aperture 102 in the cover 68 and fits in positive contact into a counter bore 104 at the lower end of the handling knob 92. A sliding disc 106 is provided between the underside of the knob 92 which has gripping surfaces, and the upper surface of the cover 68.

As may best be seen in Fig. 5 and Fig. 6, a supporting bracket 110 is integrally formed on to the bush 94, off centre. A lower surface 112 of the bracket 110 is rounded. The supporting bracket 110 may be located directly opposite to the brush 82 as shown in Fig. 3, or its location may be such that brush 82 and supporting bracket 110 are diametrically opposite to each other relative to the axis of the screw 90. In this case the filter cloth moves along between the two elements supporting bracket and brush in a step-wise fashion.

In operation, the filter according to Fig. 3 is brushed clean by turning the knob 92 at suitable intervals so that the brush 82 may remove the dust from the filter cloth 76 and allow it to drop into the casing main body 66. The latter is periodically emptied by removing the cover 68. When the cover is taken off the filter frame, the filter cloth 76 it carries, and the cleaning equipment for the filter cloth, are automatically removed together, and the main body 66 is freely accessible. Similarly, the replacement of the filter element proper is simple. All that has to be done is to loosen the screw 90 after removal of the cover, to take the brush 82 off, and finally replace the filter frame by a new one. Lastly, the screw 90 is screwed in, and the cover 68 put on.

Fig. 7 shows another filter 114 for a small pneumatic and electrical tool. The underside of the casing main body 116 is provided with outlet slots 118 and has a cover 120 which carries an intake nozzle 122. The filter casing, which consists of the casing main body and the cover, accommodates a filter element 124. The latter comprises a filter cloth 126 which has, at its edges, integrally extruded Tee-shaped webs 128 of a plastics material which are interconnected through simultaneously formed cross links 130 so that the filter element 124 constitutes a self-supporting element. The filter element 124 has a number of interconnected sections 132 which are inclined at an angle towards each other and divided the interior of the filter casing, in zig-zag form, into an intake section 134 and a discharge section 136. The points of the system formed by the zig-zag arrangement of the filter element sections are connected with integrally formed pairs of transverse bars 138 which in turn are maintained at the required spacing by supports 140. With this arrangement the filter element 124 can be accurately provided with the internal dimensions of the filter casing, and the filter element 124 may be inserted into the casing by the simple method of frictional contact. This facilitates very considerably the mounting of the filter and any work due to replacing the filter element or the insertion of a filter cloth of different permeability.

To clean the filter cloth of dust is simple in the case of the filter 114. The filter is hit against a hard surface, with the end of the casing main body 116 open.

In cases where the exchangability of filter elements is considered unimportant, the latter may be fixed by glueing at its plastics webs 128 to the injection moulded filter casing. In this case the filter element may be a continuous band of material as indicated in Fig. 9. Pieces of the required length would in this case be cut, containing part of the continuous filter cloth 126 and the plastics webs which are integrally formed with the cloth either by injection moulding or pressing, and extend in the longitudinal direction, and including cross-links 130 which connect said webs at regular spacing. The pieces cut off the continuous band are bent as desired under local heating of the plastics webs at the positions destined to connect with the cross rods. In this manner the desired zig-zag form is established. In a number of cases the zig-zag shaped filter element constructed by this method will be found to be strong enough mechanically to safely support a loosely inserted filter element.

Fig. 10 is a schematic representation of another filter 142. The filter cloth 144 is

glued between a cover 146 and a casing main body 148. The main casing body comprises, at the back of the discharge nozzle 150, an arcuate diversion section 152 which rises upwards from the casing bottom and ends just below the filter cloth 144. The cover 146 comprises, on the end remote from the intake nozzle 150, a number of discharge slots 154. To empty the casing main body 148 and remove any collected dust particles, a hinged flap 156 is provided which firmly seals off a dust collecting chamber 158.

With the filter described above, part of the incoming air stream is directed parallel to the surface of the filter cloth 144, passing thereby through the passage between the filter cloth and the upper end of the deflecting section 152 which ends immediately below the filter cloth 144. With this part of the air stream a large proportion of the dust particles clinging to the filter cloth in the region below the deflection section 152 is dislodged from the cloth and carried into the dust collecting chamber 158. In consequence of the cross-sectionally defined delay in the air stream rate, the dust particles are left behind and the carrying air stream passes through the section above the dust chamber at a lower rate so that any dust particles still contained in the carrying air stream are retained but do not firmly adhere to the filter cloth. They may be removed by shaking the particles off by slightly hitting the filter against a hard surface.

Fig. 11 shows another filter 160, a cover 164 of which is detachably connected with a casing main body 162. The casing bottom carries upwardly directed transverse ribs 166 and there are discharge slots 168 arranged therebetween. Into the casing main body 162 is glued the edge of a filter cloth 170. This filter cloth 170 is long enough to form clain-like passages 172 between the ribs. In order to ensure that these hanging passages 172 are of uniform size the filter cloth is additionally glued to the points of the ribs 166.

To clean the filter according to Fig. 11 it is hit against a hard surface, the loose dust being removed after the cover 164 is taken off.

In the case of filters of the Fig. 10 embodiment, the filter cloth is automatically cleaned by the incoming air stream.

With a filter of the embodiment of Figs. 3 to 6, the surface of the filter cloth may be kept clean with the brush moving periodically over the surface. An additional advantage is that the filter cloth, especially one of good flexibility, may be cleaned with a tightly fitting brush without stretching the filter cloth. Thus the efficiency of the brush remains perfect and no undue strain is laid on the fixing points of the filter cloth. Apart from this the filter cloth moves past the brush in a very gentle manner although it is supported.

The forces required for moving the brush as necessary, are particularly small. With respect to the small operating forces, and bearing in mind that the reaction moment exerted on the filter cloth has to be maintained at a low level, it is evident that this embodiment is also favourable.

Further, it is easy to insert or remove the filter cloth together with its supporting frame, which offers the additional advantage of extremely low forces of friction which preserve the life of the filter cloth.

With the embodiment of Fig. 11 a large active filter surface may be accommodated in the filter casing. The filter cloth will thereby conveniently adapt itself automatically to the ribs of the main casing body in consequence of which the desired zig-zag form is obtained without additional preparatory work.

In the embodiment of Figs. 1 and 2, the strip of filter cloth is automatically held taut in its zig-zag form, independently of the spatial direction of the filter and irrespectively of whether the inlet nozzle of the filter is loaded by excess air pressure. With this arrangement it is moreover ensured that the incoming air, including the solids particles carried along with the air, are evenly distributed over the various sections of the filter cloth. In addition to this the filter cloth is efficiently cleaned of dust when the movable supporting rods are displaced in a jerky quick movement.

Also the filter cloth edges create a seal against the adjacent walls of the filter casing without having to provide a mechanical connection between the cloth and said wall surfaces. This fact makes mounting and replacement of filter cloths much easier.

All movable supporting bars are uniformly displaced and in this manner it is ensured that also the filter cloth is cleaned uniformly reliably. Apart from this the simple manner of mounting the filter is considered an advantage. Not even the plate supporting the movable rods acts as a streaming resistance for the discharged, filtered air.

Such a filter is particularly easy to clean and to do this thoroughly, since the handle has to be moved inwards only. This does not even require the hands to be clean. The spring ensures that the movable supporting rods return into their original position, whereby the filter cloth is suddenly tightened, regaining its function of defining the position of rest of the movable rods, and acting as a flexible stop. In this manner the dust particles are thoroughly dislodged from the filter cloth.

In the Fig. 7 embodiment, it is not only especially convenient to glue the filter cloth into the filter casing via the plastic rods, it is also easier to handle the filter cloth because of its increased stiffness.

This embodiment has moreover the advantage of a very good inherent stiffness of the filter being combined with an essentially undi-

minished permeability to air.

With a filter of this kind the actual filter element may be used independently as it is easy to fit into the filter casing or to remove it from the latter.

Various modifications may be made without departing from the invention.

CLAIMS

1. A filter for pneumatic or electric tools having an extractor fan system, wherein the filter comprises a compact casing supporting an intake nozzle which is connectable with a discharged air nozzle on the pneumatic and electric tools.

2. A filter according to claim 1, wherein a filter cloth is fixed in a flat position and has edges glued on to the filter casing.

3. A filter according to claim 2, wherein the filter casing has a baffle section which is located behind the inlet nozzle and leading towards the filter cloth, and which is spaced by a predetermined distance from the filter cloth, an outlet for filtered air being provided at an end of the filter casing which is remote from the inlet nozzle.

4. A filter according to claim 1, wherein a brush is movably located at an intake side of a filter cloth, a supporting body, which is coupled with the brush, being located at an outlet side of the filter cloth, the brush and supporting body being positioned opposite in alignment, or laterally displaced relative to each other so that by the relative positions of the brush and supporting body a shaped passage is defined for the filter cloth.

5. A filter according to claim 1, wherein a brush is located at an intake side of a filter cloth and a supporting body is located at the other side thereof, the brush and the supporting body being pivotally mounted on a common axis inside the filter casing, such that longitudinal axes of the brush and supporting body are offset from the pivot axis.

6. A filter according to claim 4 or 5, wherein the brush and supporting body comprise integrally formed bushes, and wherein there is provided a handle for control of the brush and the supporting body, fixing means being provided to extend through the bushes and mount the brush, the supporting body, and the handle as a single unit, the filter cloth being provided with hole-strengthening rings formed of a material of low friction through which rings the fixing means extends, or the bushes being formed of a material of low friction.

7. A filter according to any of claims 4 to 6, wherein the supporting body is rounded in shape adjacent to the filter cloth.

8. A filter according to any of claims 4 to 7, wherein the filter cloth is glued on to a plane frame which is clamped between projections of a casing cover and a casing main body.

9. A filter according to claim 1, wherein a filter cloth is fixed inside the filter casing in zig-zag form, the cloth edge being glued on to the filter casing, and the cloth being supported in zig-zag form by ribs of the filter casing and extending between said ribs.

10. A filter according to claim 1, wherein a filter cloth passes over two sets of supporting rods which are displaced relative to one another, one of the sets being movable whereby in one of the sets of supporting rods the distance from the axis of the inlet nozzle increases in proportion to an increasing axial distance from the inlet nozzle.

11. A filter according to claim 10, wherein springy clamping braces act at the edges of the filter cloth and stretch the latter in a transverse direction, the spring ends resting against edge seams of the filter cloth.

12. A filter according to claim 10 or 11, wherein said one set of supporting rods are prestressed by a spring in a direction away from the supporting rods of the other set which are stationary, and are supported on a connecting plate having holding units each of the latter having an opening through which a respective supporting rod of said one set can resiliently enter the holding unit to be retained thereby together with the filter cloth which is stretched across the supporting rods.

13. A filter according to claim 1, wherein edges of a filter cloth have spray moulded plastic webs, which extend in the longitudinal direction of the filter cloth and are interconnected through spray moulded plastic transverse elements, the filter cloth being glued into the filter casing with the aid of the plastics webs and being folded in a zig-zag arrangement with the aid of the plastic webs, the cloth at the points of the zig-zag being connected to spray moulded transverse elements of a plastics material.

14. A filter according to any of the preceding claims, wherein the filter casing comprises a principal casing body and a detachable cover through which access is given to a dust collecting chamber.

15. A filter according to any of the preceding claims, wherein the inlet nozzle has a bellows section which is directionally adjustable.

16. A filter for pneumatic or electric tools having an extractor fan system, substantially as hereinbefore described with reference to the accompanying drawings.

17. Any novel subject matter or combination including novel subject matter herein disclosed, whether or not within the scope of or relating to the same invention as any of the preceding claims.

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